Ernest W. Ellis

MEMORANDUM ON KEENAN PROPERTIES, Inc.

About: Recalculation and comparison of Johnson and Amundson results
By: Bill Broadgate
Date: June 2, 1952

DEPARTMENT OF THE INTERIOR
Defense Library Administration
JUN 3 1952

Conclusions

1. It appears that the distances between trenches were incorrectly measured by Johnson and a recheck of scale maps and a yardage recalculation using the same average depths as Johnson indicate 80% more yardage for the areas tested.

2. Due to the method of preparing the samples most of the Johnson assay results exclusive of gold are unreliable, as the "traces" and "nils" reported probably were due to insufficient concentration. The Amundson rechecks in the same trenches were highly concentrated and gave positive results. The Johnson "composite" sample is very likely the most accurate as it shows values on the order of Amundson's. Johnson must have realized this as he used this composite sample in calculating the "values exclusive of gold" and the "weight of products" exclusive of gold for the entire area tested.

3. (a) Attention should be directed to arithmetical errors in the Johnson report which materially alter his calculation of values and weights based on the "composite" sample. (see explanation attached).

(b) The "indicated average value of all gravel tested exclusive of gold", using Johnson's prices but correcting the computations, proves to be $0.792 per cubic yard rather than $0.719 as computed by Johnson.

(c) The weight of gravel per cubic yard commonly used in the test area (and used by Amundson) is 2800 lbs. The figure used in the Johnson report is 2700 lbs., a figure convenient for the calculations. This introduces a small but appreciable lowering in reported values.

(d) According to the assay certificate the tantalite value in the composite sample should be 0.12% instead of 0.1% introducing a further error on the low side.

4. The prices used by Johnson of Sn $1.00, WO_3 $3.00, Te_2O_5 $2.50, Cb_2O_5 $2.50, are low. More realistic prices would be Sn $1.21, WO_3 $3.00, Ta_2O_5 $3.00, Cb_2O_5 $3.00, and recalculations have been made on this basis. Under the DMPA Columbium-Tantalum Purchase program, announced May 28, 1952, the price plus bonus will yield the producer still higher returns.

5. (a) The gross value of the area tested according to the uncorrected Johnson report is $247,051 or 88.3¢ per cu.yd. (actually calculates out $1.085 per cu. yd.).

(b) The gross value of the area tested using the Amundson assays and the additional yardage calculated from the scale maps is $779,000 or $1.54 per cu. yd. (Note: This figure must be considered in the light of Amundson only being able to recheck 5 trenches. The two #4 samples for this calculation were combined). The difference is $532,000 additional values.

(c) The gross weight of products other than gold are:

According to Johnson		Amundson - Keenan
Sn	88 tons	164 tons
WO_3	0.86 tons	7.0 tons
Cb_2O_5	2.8 tons	7.0 tons
Ta_2O_5	1.2 tons	3.68 tons

6. There is reason to suppose that the lighter minerals may have been subject to selective deposition and that greater amounts may be found downstream where they could settle more easily during flood periods.

7. Unfortunately all the errors in computation in the Johnson report tend to minimize the sampling results.

8. There appears to be grave doubt that the jigs were correctly operated, either with regard to proper bedding or the volume of water applied, which seems to have been excessive.

9. Phase 1 was not designed to evaluate yardages but to determine the presence of values and it would appear that regardless of whether there is or is not agreement about the validity of these recalculations the project has sufficient merit to warrant the required expenditure for phase 2.

[Note] All calculations are slide-rule approximations.

Yardage

Evidently due to some confusion of scale or map measurement the Johnson report appears not to report sufficient yardage for the areas tested. The comparison is as follows:

Block Number	Johnson Report	Recalculation
1	88,148	200,000
2	26,520	53,600
3	25,132	48,880
4	24,300	45,920
5	28,531	37,330
6	28,963	44,722
7	13,416	17,569
8	11,170	22,340
9	34,074	34,074
	280,254	504,437

The actual yardage in these 9 blocks seems to be about 80% greater than Johnson reported. This will result in a substantial increase in the potential tonnages of metals present beyond what is shown on the Johnson "composite" sample sheet.

Tons of recoverable metal exclusive of gold

Based on Johnson "composite" sample assays:

	Johnson shows:	Using Actual yardage
Sn	88 tons	158 tons
WO_3	0.86 tons	2.16 "
Cb_2O_5	2.8 "	5.19 "
Ta_2O_5	1.2 "	2.27 "

The total value of this material according to Johnson is $201,500 ($0.719 X 280,254). If we use the more realistic prices of $1.21 per pound for tin and $3.00 per pound each for the other metals, the value of the Johnson "composite" sample correctly calculated would be $0.98 per cu. yd. Using the recalculated yardage the total value would become $495,000 exclusive of the gold.

From the operating standpoint the 80% increase in yardage and the $294,500 increase in gross rare metal values is of substantial importance.

It should be noticed that the individual samples taken by Johnson at each trench were concentrated to such large volume that tungsten, tantalite and columbite often showed merely as a trace. Consequently the values shown in his calculation of the individual blocks are too low.

The "composite" sample was concentrated on a more commercial basis and gives results closer to the Amundson tests, as follows:

	Pounds per cubic yard	
	Johnson Composite	Amundson Average of six samples
Sn	0.628	0.652
WO_3	0.0062	0.0278
Cb_2O_5	0.0206	0.0277
Ta_2O_5	0.009	0.0146

Comparing the Johnson yardage and assays for the "composite" sample with six Amundson samples taken from five trenches which were open subsequent to the Johnson operation and using the recalculated Keenan yardage shows the following tonnages of metal:

	Johnson-280,000 cu.yds.	Amundson-Keenan-504,000 cu.yds.
Sn	88 tons	164 tons
WO_3	0.86 tons	7.0 tons
Cb_2O_5	2.8 "	7.0 "
Ta_2O_5	1.2 "	3.68 "

Using realistic values of $1.21 per pound for tin and $3.00 per pound for the other metals the gross values are as follows, exclusive of gold:

Amundson-Keenan	$503,080
Johnson	241,660
Difference	$261,420

Discussion of Discrepancies in Johnson Composite Sample Calculations

Johnson states the total concentrate weight to be 2230 lbs. Examination of the individual sample weights shows this figure should be 2130 lbs. The rejects as given by Johnson to be 1440 lbs. actually weighed 1312 lbs. according to a record made September 24, 1951. The weight of the concentrates, 70.9 lbs., appears to be correct.

Substituting these figures in the wording of the Johnson report, "the total concentrates from all samples was 2130 lbs. Of this the rejects amounting to 1312 pounds, or 61.5%, were reconcentrated to 70.9 pounds."

Adding the volume of all samples gives 319.5 cu. ft. or 11.8 cu. yds. The next sentences on Johnson's composite sample sheet then should read:

"The total volume in all samples was 11.8 cu. yds. 11.8 X .615% = 7.27 cu. yds., which in turn represent the yardage from which the 1312 pounds were derived."

The indicated average value of all gravel tested exclusive of gold then becomes $0.788¢ per cu. yd. as follows:

	Assay %		Lbs. Conc.		Val. per lb.		cu. yds.	
Tin	7.0	X	70.9	X	$1.00	÷	7.27	= $.682 per cu.yd.
WO_3	.07	X	70.9	X	3.00	÷	7.27	= .0204
Cb_2O_5	.23	X	70.9	X	2.50	÷	7.27	= .0560
Ta_2O_5	.12	X	70.9	X	2.50	÷	7.27	= .0292

Adding to the 0.788¢ the actual gold values calculated from the Johnson assays we get $0.788 + $0.297 = $1.085 per cu. yd. or $304,000 for the value of 280,000 cu. yds. instead of $247,000.

Gold Values

There is an obvious discrepancy in the Johnson report. This can be seen readily if one takes the average indicated value of all metals exclusive of gold, ($0.719 per yard) and calculates the average total gold value per yard from the summary sheet as follows:

Total Johnson yardage 280,000
Total Johnson values $247,000

$$\frac{\$247,000}{280,000} = .883 - .719 = 16.4¢ \text{ per yard gold.}$$

The gold values calculated from the Johnson separate concentrate assays actually equal 29.7¢ per cu. yard. (If the dubious results from trench #1 were eliminated, the values would be raised to 41¢ per cubic yard). The error lies in the fact that the figure of $247,000 for the gross value taken from the Johnson summary sheet does not contain the same values for "metals exclusive of gold" that were found in the composite sample. A cursory examination of the evaluation tabulations for each trench or block will show this.

Corrected Johnson results:

The value of 280,000 yards at $0.788 per cu. yd. is actually $221,000. The value of 280,000 cu. yds. @ $0.297 per cu. yd. is $83,000. Then the actual gross value of the 280,000 cu. yds. based on Johnson's own assays is $304,000 or an average value of $1.085 per cu. yd. including gold, at the prices Johnson used, and not the $247,051 that he shows in his report.

Using the more realistic prices, the values per cu. yd. would be:

Gross value of metals,	$274,000
Gross value of gold,	83,000
Total gross value	$357,000

$$\frac{\$357,000}{280,000} = \$1.27 \text{ per cu. yd.}$$

Amundson-Keenan results:

The average gold value shown by Amundson's results is 60¢ per cu. yd.

The average value of metals exclusive of gold calculated from Amundson's results and priced at the more realistic figure is $0.967 per cu. yd.

The recalculation of total yardage in the 9 blocks is 504,000 cu. yds.

Gross value of metals	$477,000
Gross value of gold	$302,000
Total value of 9 blocks	$779,000

$$\frac{779,000}{504,000} = \$1.54 \text{ per cu. yd.}$$

Using the corrected Johnson value of $1.27 per cu. yd. and the Keenan yardage calculation the gross value of the 9 blocks would be $642,000, as against the Amundson-Keenan $779,000.

It may be noted that had the factor of 2800 lbs. per cu. yd. been used instead of 2700, the corrected Johnson gross value based on his 280,000 cu. yard measurement would be raised from $304,000 to $316,000 and the above figure of $642,000 would become $668,000.

Mineral Values in Heads Computed from Bribach Assays of Concentrates

KEENAN PROPERTIES

Placer gravels, Potato and Bear Creeks, near Spearfish, South Dakota

Re-Check on DMA Project Sampling October 1-18, 1951

	Lbs. of Concentrate per cu. yd.	Gold value per cu. yd.	Metallic Tin lbs. per cu. yd.	Cb_2O_5 lbs. per cu. yd.	Ta_2O_5 lbs. per cu. yd.	WO_3 lbs. per cu. yd.
Trench 4 Concentrate recovery Re-check All Jig test	2.68	$1.55	1.185	0.0927	0.0517	0.026
Trench 2 Sluice and Jig concentration	1.87	38 7/10¢	0.59	0.0168	0.0087	0.023
Trench 4 Sluice and Jig concentration	1.95	53 6/10¢	0.694	0.0224	0.0121	0.0198
Trench 6 Sluice and Jig Concentration	1.45	23 2/10¢	0.299	0.002175	0.00103	0.0558
Trench 8 Sluice and Jig Concentration	2.4	58 3/10¢	1.02	0.029	0.01295	0.0314
Trench 9 Sluice and Jig Concentration	1.6	31 8/10¢	0.1312	0.00304	0.00144	0.00928

REPORT

KEENAN PROPERTIES

D.M.A. Project - 1 DM 258 Docket 654X
Exploration - Walter W. Johnson Company
Bureau of Mines Observer - L. E. Shaffer
Assayer - Oscar N. Bribach

The Keenan Properties comprise holdings on upper Beaver Creek, Bear Creek and Potato Creek in the Bear Creek Mining District, Lawrence County, South Dakota, about 12 miles southwest of Spearfish, South Dakota.

During August and September 1951 Bear Creek was tested for a distance of 1.6 miles with an average width of 114 feet by digging 5 trenches to bedrock from rim to rim of the creek and spaced as indicated on the accompanying map. Potato Creek was tested for a distance of 1.05 miles with an average width of 87 feet by digging 4 trenches to bedrock from rim to rim of the creek and spaced as mapped, making a total of 9 trenches in all for both creeks.

The C.M.A. Project arrangement called for a total of 5 trenches, - 3 trenches on Bear Creek and 2 trenches on Potato Creek. We could have followed through on that basis but, in view of the fact that both the bulldozer and dragline were on a minimum thirty-day rental contract, the thought occurred that the intent of this exploration effort could best be served if more trenches, embracing a much larger area, could be dug and sampled and yet remain within the allocation. With the cooperation and approval of Mr. Donald Mullen of the Bureau of Mines this was done. Therefore our evaluation of Bear Creek and Potato Creek is predicated on the results from 9 trenches instead of the 5 trenches first planned under the project.

Bedrock - Schist and Porphyry bedrock prevails. Where encountered it was more or less decomposed and soft. It could be easily mined for the recovery of bedrock values.

Water - There is a small flow of water in both Bear Creek and Potato Creek, until about August 1. Additional water for washing during July, August, and possibly September, would have to be provided from impounding dams and repumping water collected downstream from the washing plant.

Some trenching was done on Beaver Creek at the junction of, and below, Potato Creek, from which pan samples were taken. This report, however, is confined to work done on Bear Creek and Potato Creek. Trench No. 1 on Bear Creek was started on August 17, 1951. The cutting and sluicing of samples from Trench No. 1 immediately followed on August 21, 1951.

With reference to attached maps and photographs, Bear Creek and Potato Creek were trenched in selected areas to bedrock from rim to rim of the creek bed and samples were taken, as indicated, by cutting 6"x 24" channels from the surface to bedrock. All of the material from each channel cut, representing 1 cu. ft. for each foot of depth, was sluiced and jigged to produce a concentrate for determining by assay the contained metals of interest, - namely, Tin Sn, Tungsten WO_3 and Columbite Cb-Ta. The value in gold was determined by panning the concentrates from each run and then amalgamating, parting and weighing the free gold.

Trenching - The deeper trenches were dug with a dragline assisted by a bulldozer, which built roads and cleared the surface of trees and brush. The shallow trenches were dug with the bulldozer. When necessary, the trenches were provided with bedrock drains to prevent the accumulation of water and keep the trenches open to facilitate better sampling and also to preserve them for further sampling, if desired.

The 6"x 24" sample channels were spaced 10 feet on centers across the face of the trench. The samples so taken were approximately 20% of the exposed area of gravel from surface to bedrock and from rim to rim of the creek bed.

Sluicing Equipment - The equipment consisted of a jig and sluice box set-up. The jig, a two-cell 12" Pan American Crangle type, was set midway between 20 feet of sluice boxes 12 inches wide. The head sluice was fitted with a feed hopper equipped with a screen plate perforated with 3/8" holes.

The gravel was shoveled into the hopper, where it was thoroughly washed, - the fines dropped into the sluice and oversize was rejected.

The sluice boxes proper, both head and tail, were riffled for the entire length with 5 layers of fly screen covered with diamond mesh expanded metal

and all held in place with full length cleats and wedges.

Water for operating the jig and for sluicing the gravel was supplied by a 3" pump, which could be controlled perfectly for the desired amount of water required.

The concentrates from each run were made up of the jig bed recoveries, the jig hutch product and the concentrates from both the head sluice and the tail sluice.

The entire concentrate was mixed, dried, weighed and sampled. Samples were cut with a Jones type sampler. 6 cuts were taken from each batch of concentrates. Of the 6 cuts, or samples, 4 were for assaying and 2 large samples were held to furnish material for working out a flow sheet for a re-treatment plant for making high grade commercial products, should the results of the field sampling and evaluation support that step. The 6 samples were equally divided between the owner, Keenan Properties, and the Bureau of Mines observer.

When the assay samples were cut from the separate concentrates of each sluicing, the reject from each sample, as put through the Jones sampler, was a proportionate part of the concentrate.

The rejects of all samples were saved and mixed, making a composite representative of all concentrates produced from both Bear Creek and Potato Creek.

This composite concentrate was reconcentrated in the sluice box and jig set-up to produce a composite sample of the entire area tested. This composite sample was dried, weighed and divided for assay. The evaluation of this sample appears later in this report.

Assays - The assays upon which this report is based were made by Oscar N. Bribach, who was selected by the owner, Keenan Properties.

Some of the assay certificates indicated that percentages of the various metals less than .05 were stated as nil, or traces. Such low values were accountable to extremely low grade heads and the low ratio of concentration produced by the combining of the sluice and jig concentrates. Had the assay

certificate reporting the first samples been made immediately available to us instead of being withheld by Keenan Properties until too late to act, we would have requested the assayer to include a step in his procedure that would have resulted in closer determinations. For instance, as in any beneficiation step, a screen test should have been made to learn within what range of sizes the values rested and, as is generally the case with placer sands, the coarse material may have been rejected, leaving the finer sands relatively enriched. The indicated presence of WO_3 and combined Cb-Ta is somewhat low throughout the deposits in Bear Creek and Potato Creek.

That these minerals have been reported as "traces" only in many of the samples assayed is evidently due to the fact, as stated, that Mr. Bribach did not carry his calculations lower than .05% and below which point he did not indicate the actual values but reported them as traces, or nil. It is assumed that Mr. Bribach made .05 the end point in his calculations because he considered values below .05% to be non-commercial.

On the other hand, identical samples to those assayed by Mr. Bribach were assayed by the Bureau of Mines, and in all samples the Bureau found these rare minerals present with a calculated end point below .01%.

Attention is called to this comparison of assay results between the Bureau of Mines and those of Mr. Bribach merely to show why in so many instances our tabulations of values covering WO_3 and Cb-Ta were stated as traces, or nil, when based upon Mr. Bribach's assays.

Obviously, had Mr. Bribach carried his end point to the lower limits used by the Bureau of Mines, then more of the samples would have at least shown the presence of these metals. Again, to clear up a situation arising from a false assumption and having to do with a misinterpretation of our method of sampling and evaluation, we refer to the checking of our work and results by Mr. Earl Amundson of Spearfish, South Dakota. Mr. Amundson, who was called in to make a re-check by the owners, was without question unaware of, and not informed as to, the procedure followed to determine the value of the samples we submitted for assay.

In order to visualize our method of sampling and evaluation it is necessary to follow the steps taken, from cutting the head samples in the trenches to the collecting and combining of the bulk concentrates from the sluice boxes and the jig. This bulk concentrate, which amounted to as much as 120 pounds from a single channel cut, was, in turn, dried, mixed and put through a Jones type sampler to produce the samples for the Bureau of Mines and Mr. Bribach.

Take Samples 34 to 40 of Trench 4 as an example:

From channels cut in the trench, 22 cu. ft. of gravel was sluiced and jigged. The resultant concentrate amounted to 98 pounds. Therefore, if 98 pounds were obtained from 22 cu. ft., then the product in pounds of a concentrate of the same grade for 27 cu. ft., or one cubic yard, would be 22:98 :: 27:x = 119 pounds concentrate per cubic yard.

Amundson's procedure follows:

Amundson's channel cut from the same trench amounted to about 17.9 cu. ft. computed from his dry weight of 1847 pounds and the figure of 2800 pounds for a cubic yard. The 1847 pounds of gravel was sluiced, producing 55 pounds of sluice box concentrates. This 55 pounds of sluice box concentrates was, in turn, re-concentrated by panning to a final product, or concentrate, which weighed but 1.25 pounds. This 1¼ pounds was submitted for assay.

Obviously, the false assumption can be traced to the mistaken idea that our assay sample, which was less than 3% of our total concentrates, should be comparable in grade to the 1¼-pound total and final concentrate produced by Amundson.

As an illustration, we compute both Johnson and Amundson evaluation in values for tin per cubic yard of gravel in bank:

Johnson Trench 4 = 119 lbs. conc. per cu. yd.

Amundson Trench 4 = 1.28:17.8 :: x:27 = 1.9 lbs. conc. per cu. yd.

Johnson Assay - Tin .6% x 119 = .71 lbs. per cu. yd.

Amundson - Tin 35.7% x 1.9 = .67 lbs. per cu. yd.

When the methods of evaluation are understood, it will be seen that the results in both cases are very close, - erasing all doubt and leaving nothing to be concerned about as to the accuracy with which the work was done.

Re-treatment of Concentrates - First, a study should be made as to the economic point to which field concentration can be carried.

Second, the rougher concentrate from the field should be subjected to a mill test for the production of marketable products and the establishing of a flow sheet for a commercial unit.

Material for doing this work was anticipated and provided for by the large quantities of concentrates from each jig run that were left in the care of the owner. An equal amount of these same rougher concentrates was taken by the Bureau of Mines engineer, Mr. L. E. Shaffer, to be held for such use or determinations as may arise.

It should be borne in mind that all values stated are gross values, from which all costs having to do with mining, re-treatment to grade as marketable products, and shipment of same, must be taken into account.

There are approximately 280,000 cu. yds. of gravel in the areas sampled, which can be mined by the combined use of a bulldozer and a portable washing plant equipped with jigs.

The area, containing 280,254 cu. yds., has a gross value for gold, cassiterite, scheelite, columbite, and tantalite of approximately $247,051.00.

Walter W. Johnson

Walter W. Johnson, M. E.

February 15, 1952

BEAR CREEK SUMMARY OF YARDAGE AND VALUES FOR AREA SAMPLED

	Sq.ft. Bedrock	Cubic Yards	Gross Value All Metals	Au? Val./cu.yd.		
Block 1	238,000	88,148	$ 24,990.00	$0.28		
Block 2	178,125	26,520	$ 44,065.00	$1.66		
Block 3	123,375	25,132	$ 33,928.00	$1.35		
Block 4	211,650	24,300	$ 44,446.00	$1.83		
Block 5	220,100	28,531	$ 41,819.00	$1.46		
TOTALS	971,250	192,631	$189,248.00	192,631 cu.yds.	$189,248.00	98¢/cu.yd.

POTATO CREEK SUMMARY OF YARDAGE AND VALUES FOR AREA SAMPLED

	Sq.ft. Bedrock	Cubic Yards	Gross Value All Metals	Au? Val./cu.yd.		
Block 6	170,000	28,963	$ 10,540.00	$0.36		
Block 7	78,750	13,416	$ 4,882.00	0.36		
Block 8	52,000	11,170	$ 18,304.00	1.63		
Block 9	195,750	34,074	$ 24,077.00	0.71		
TOTALS	496,500	87,623	$ 57,803.00	87,623 cu.yds.	$ 57,803.00	[illegible]

TOTALS FOR AREA SAMPLED ON BEAR AND POTATO CREEKS 280,254 cu.yds. $247,051.00 [illegible]

COMPOSITE SAMPLE

The total concentrates from all samples was 2230 pounds. Of this the rejects amounting to 1440 pounds, or 65%, were reconcentrated to 70.9 pounds.

The total volume in all samples was 12.2 cubic yards. 12.2 x .65 = 7.9 cu. yds., which in turn represent the yardage from which the 1440 pounds were derived.

Assay	%		Lbs. Conc.		Val. per Lb.		Cu. Yd.		
Tin	7.0	x	70.9	x	$1.00	÷	7.9	=	$.628 per cu.yd.
WO_3	.07	x	70.9	x	$3.00	÷	7.9	=	.018 per cu.yd.
Cb_2O_5	.23	x	70.9	x	$2.50	÷	7.9	=	.051 per cu.yd.
Ta_2O_5	.1	x	70.9	x	$2.50	÷	7.9	=	.022 per cu.yd.

Indicated average value of all Gravel tested exclusive of gold $.719 per cu.yd.

Weight of products in Bear and Potato Creeks based on indicated values in "composite sample".

Tin	lbs.	per	cu.yd.		.628	x 280,254	=	176,000	88.0 Tons
WO_3	"	"	"	"	.0062	x 280,254	=	1,738	.86 "
Cb_2O_5	"	"	"	"	.0206	x 280,254	=	5,773	2.8 "
Ta_2O_5	"	"	"	"	.009	x 280,254	=	2,522	1.2 "

SAMPLES

Each channel sample represents one square foot of bedrock. Where combined channel samples were sluiced, the resultant concentrate is divided by the number of samples making up the combined sample to arrive at the value per square foot of bedrock.

VALUE OF METALS

Tin Sn - $1.00 per pound FOB Spearfish, South Dakota

Tungsten - WO_3 - $3.00 per pound FOB Spearfish, South Dakota

Columbite - Cb_2O_5 - $2.50 per pound FOB Spearfish, South Dakota

Tantalite - Ta_2O_5 - $2.50 per pound FOB Spearfish, South Dakota

Gold - 10 milligrams equal 1 cent

EVALUATION - TRENCH NO. 1 BEAR CREEK

		Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	
8.5	92.5	0.2	.185	18.5	nil			nil			nil			1.6	.16	18.6	1	(925 x 18.6) 17
7.5	66.0	0.01	.006	.6	nil			nil			nil			7.3	.7	1.3	1	"
9.1	85.0	0.1	.085	8.5	nil			nil			nil			5.8	.58	9.0	1	7[illegible]
9.8	91.0	0.1	.09	9.0	nil			nil			nil			50.4	5.0	14.0	1	" 12[illegible]
9.8	86.0	0.1	.086	8.6	nil			nil			nil			nil		8.6	1	" 734
21.1	85.6	0.1	.085	8.5	nil			nil			nil			41.5	4.1	12.6	2	5[illegible]
12.3	84.0	0.1	.08	8.0	tr			tr			tr			65	6.5	14.5	1	1215
13.5	75.0	0.2	.15	15	nil			nil			nil			27	2.7	17.7	1	1327
13.0	85.0	0.1	.085	8.5	tr			nil			nil			17	1.7	10.2	1	Av. val. 867
7.6	95.0	0.1	.09	9.0	nil			nil			nil			3.5	.3	9.3	1	sq.ft. bed-rock 883
	843.1 no assay certificate																	9420 11.1

112.2 ÷ 11 = 10 feet average depth

115.2 ÷ 11 = 10.5¢

Block No. 1 - Based on Trench No. 1

L 1700' x W 140' = 238,000 sq.ft. bedrock

238,000 sq.ft. x 10' D = 2,380,000 cu.ft.

2,380,000 cu.ft. ÷ 27 cu.ft. = 88,148 cu.yds.

238,000 sq.ft. x 10.5¢ = $24,990.00 - Val. Block 1

$24,990.00 ÷ 88,148 = 28¢ av. val. per cu.yd.

EVALUATION - TRENCH NO. 2 BEAR CREEK

		Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	
5.	85.0	0.1	.085	8.5	nil			nil			nil			105	10.5	19.0	1	1615
8.6	88.0	0.2	.176	17.6	nil			nil			nil			521	52.1	69.7	2	3166.5
7.2	87.0	0.1	.087	8.7	nil			nil			nil			350	35.0	43.7	2	Av. val. 1900.4
8.2	120.7	0.1	.12	12.0	nil			tr			tr			365	36.5	48.5	2	sq.ft. bed-rock 2927.9
11.2	116.0 496.7	0.3	.348	34.8	tr			0.05		14.[illegible]	tr			245	24.5	73.8	3	2853.6

40.2 ÷ 10 = 4.02 feet av. depth

253.9 ÷ 10 = 25.3¢ 1236.9 24.9

Block No. 2 - Based on Trench No. 2

L 1875' x W 95' = 178,125 sq.ft. bedrock

178,125 sq.ft. x 4.02' = 716,062 cu.ft.

716,062 cu.ft. ÷ 27 cu.ft. = 26,520 cu.yds.

178,125 sq.ft. x 25.3¢ = $44,065.00 - Val. Block 2

$44,065.00 ÷ 26,520 cu.yds. = $1.66 av. val. per cu.yd.

EVALUATION - TRENCH NO. 3 BEAR CREEK

			Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
	depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	Av. val. sq.ft. bed-rock
26-29-30	27.3	131.0	0.5	.655	65.5	tr			0.09	.117	29.2	0.05	.065	16.3	455	45.5	156.5	5	
2	11.5	93.0	0.1	.093	9.3	tr			tr			tr			260	26.	35.3	2	

38.8 ÷ 7 = 5.5 feet av. depth

191.8 ÷ 7 = 27.5¢

Block No. 3 - Based on Trench No. 3

L 1175' x W 105' = 123,375 sq.ft. bedrock

123,375 sq.ft. x 5.5' = 678,562 cu.ft.

678,562 cu.ft. ÷ 27 cu.ft. = 25,132 cu.yds.

123,375 sq.ft. x 27.5¢ = $33,928.00 - Val. Block 3

$33,928.00 ÷ 25,132 cu.yds. = $1.35 av. val. per cu.yd.

EVALUATION - TRENCH NO. 4 BEAR CREEK

			Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
e	depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	Av. val. sq.ft. bed-rock
36 9-40	22.1	98.0	0.6	.58	58.0	tr			0.14	.137	34.3	0.07	.068	17.0	390	39.	148.3	7	

22.1 ÷ 7 = 3.1 ft. av. depth

148.3 ÷ 7 = 21¢

Block No. 4 - Based on Trench No. 4

L 2075' x W 102' = 211,650 sq.ft. bedrock

211,650 sq.ft. x 3.1' = 656,115 cu.ft.

656,115 cu.ft. ÷ 27 cu.ft. = 24,300 cu.yds.

211,650 sq.ft. x 21¢ = $44,446.00 - Val. Block 4

$44,446.00 ÷ 24,300 cu.yd. = $1.82 av. val. per cu.yd.

EVALUATION - TRENCH NO. 5 BEAR CREEK

			Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
ple No.	depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	Av. val. sq.ft. bed-rock
2-43 46-47	25.6	120	0.5	.60	60.	tr			0.12	.144	36.	0.06	.072	18.	205	20.	134	7	

25.6 ft. ÷ 7 = 3.5 ft. av. depth

134 ÷ 7 = 19¢

Block No. 5 - Based on Trench No. 5

L 1775' x W 124' = 220,100 sq.ft. bedrock

220,100 sq.ft. x 3.5' = 770,350 cu.ft.

770,350 cu.ft. ÷ 27 cu.ft. = 28,531 cu.yds.

220,100 sq.ft. x 19¢ = $41,819.00 - Val. Block 5

$41,819.00 ÷ 28,531 cu.yds. = $1.46 av. val. per cu.yd.

EVALUATION - TRENCH NO. 6 POTATO CREEK

ple o.	depth feet	lbs. conc.	Tin - Sn $1.00 per lb. assay of conc.	lbs. in conc.	val. of conc. cents	Tungsten WO_3 $3.00 per lb. assay of conc.	lbs. in conc.	val. of conc. cents	Columbite Cb_2O_5 $2.50 per lb. assay of conc.	lbs. in conc.	val. of conc. cents	Tantalite Ta_2O_5 $2.50 per lb. assay of conc.	lbs. in conc.	val. of conc. cents	Gold 10 mg. = 1¢ mg. in conc.	val. of conc. cents	All Metals Total val. of conc. cents	Sq.ft. bed-rock	Av. val sq.ft. bed-rock
2-53 55	23.0	94.0	0.2	.18	18.0	0.01	.009	2.8	nil			nil			100	10.0	30.8	5	

23' ÷ 5 = 4.6' av. depth

30.8 ÷ 5 = 6.2¢

Block No. 6 - Based on Trench No. 6

L 1700' x W 100' = 170,000 sq.ft. bedrock

170,000 sq.ft. x 4.6' = 782,000 cu.ft.

782,000 cu.ft. ÷ 27 cu.ft. = 28,963 cu.yds.

170,000 sq.ft. x 6.2¢ = $10,540.00 - Val. Block 6

$10,540 ÷ 28,963 cu.yds. = $.36 av. val. per cu.yd.

EVALUATION - TRENCH NO. 7 POTATO CREEK

			Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
le.	depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	Av. val. sq.ft bed-rock
-50	13.9	60.5	0.1	.06	6.0	tr			tr			tr			125	12.5	18.5	3	

13.9 ft. ÷ 3 = 4.6 ft. av. depth

18.5 ÷ 3 = 6.2¢

Block No. 7 - Based on Trench No. 7

L 1050' x W 75' = 78,750 sq.ft. bedrock

78,750 sq.ft. x 4.6' = 362,250 cu.ft.

362,250 cu.ft. ÷ 27 cu.ft. = 13,416 cu.yds.

78,750 sq.ft. x 6.2¢ = $4,882.00 - Val. Block 7

$4,882.00 ÷ 13,416 = $.36 av. val. per cu.yd.

EVALUATION - TRENCH NO. 8 POTATO CREEK

			Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
ple o.	depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	Av. val. sq.ft. bed-rock
-57	11.6	94.0	0.2	.188	18.8	0.01	.009	2.7	0.1	.094	23.5	.05	.047	11.7	138	13.8	70.5	2	

11.6 ÷ 2 = 5.8 ft. av. depth

70.5 ÷ 2 = 35.2¢

Block No. 8 - Based on Trench No. 8

L 1300' x W 40' = 52,000 sq.ft. bedrock

52,000 sq.ft. x 5.8' = 301,600 cu.ft.

301,600 cu.ft. ÷ 27 cu.ft. = 11,170 cu.yds.

52,000 sq.ft. x 35.2¢ = $18,304.00 - Val. Block 8

$18,304.00 ÷ 11,170 cu.yds. = $1.63 av. val. per cu.yd.

EVALUATION - TRENCH NO. 9 POTATO CREEK

			Tin - Sn $1.00 per lb.			Tungsten WO_3 $3.00 per lb.			Columbite Cb_2O_5 $2.50 per lb.			Tantalite Ta_2O_5 $2.50 per lb.			Gold 10 mg. = 1¢		All Metals		
ple o.	depth feet	lbs. conc.	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	assay of conc.	lbs. in conc.	val. of conc. cents	mg. in conc.	val. of conc. cents	Total val. of conc. cents	Sq.ft. bed-rock	Av. val. sq.ft. bed-rock
-63 -66	32.1	98	0.2	.196	19.6	tr			tr			tr			670	67.0	86.6	7	

32.1 ÷ 7 = 4.7 ft. av. depth

86.6 ÷ 7 = 12.3¢

Block No. 9 - Based on Trench No. 9

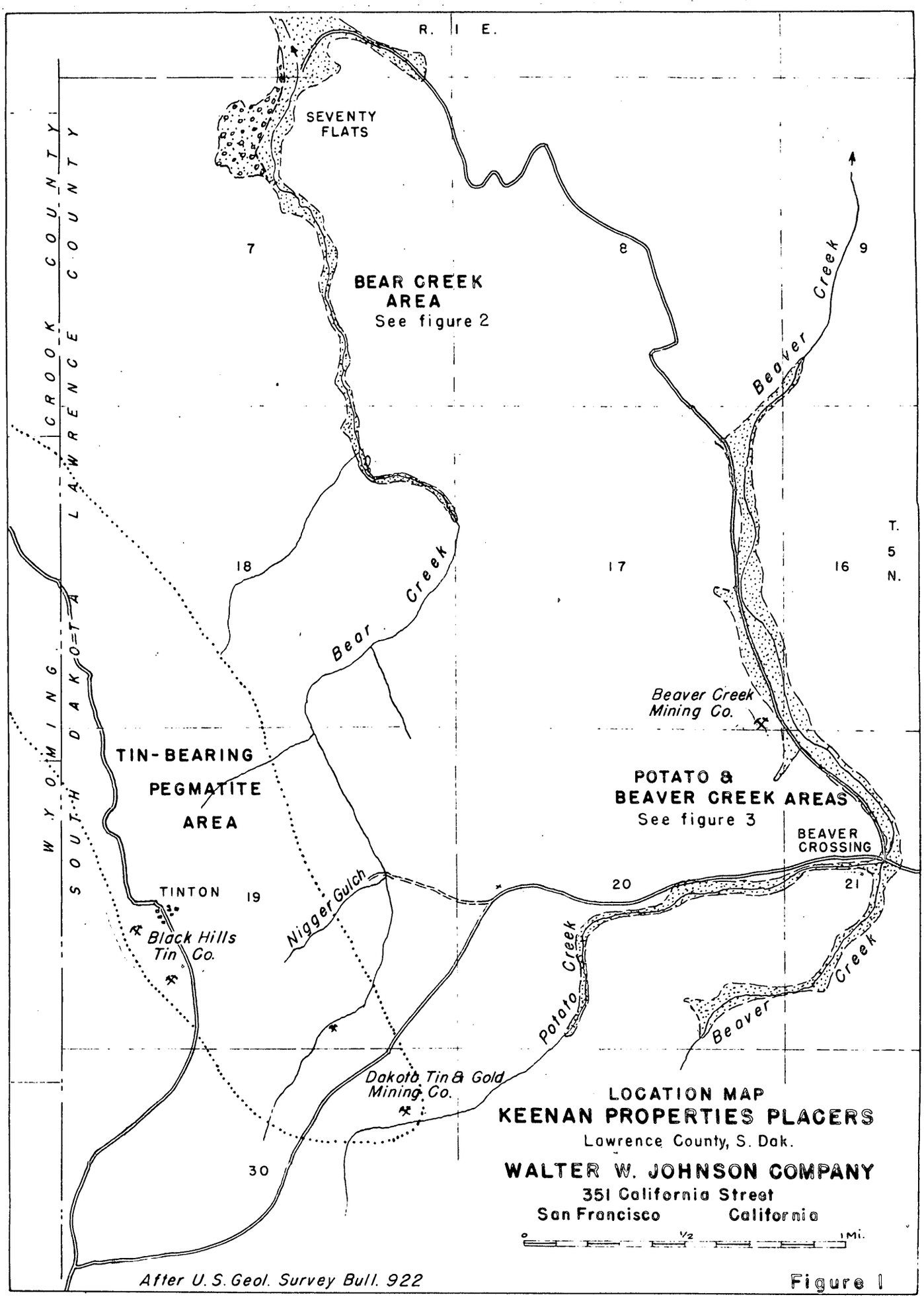
L 1450' x W 135' = 195,750 sq.ft. bedrock

195,750 sq.ft. x 4.7' = 920,025 cu.ft.

920,025 cu.ft. ÷ 27 cu.ft. = 34,074 cu.yds.

195,750 sq.ft. x 12.3¢ = $24,077.00 - Val. Block 9

$24,077.00 ÷ 34,074 cu.yds. = $.70 av. val. per cu.yd.



After U.S. Geol. Survey Bull. 922

Figure 1

Trench 1
Digging Bedrock Drain

Trench 1
Bedrock Drain

Trench 1
Bear Creek

Trench 1
Bear Creek

Trench 2

Jig and Washing Plant

Trench 3

Bear Creek between Trenches 4 and 5.

Trench 4

Piled Overburden
Early Day Mining

Trench 5
Bear Creek

Looking Down Bear
Creek Road

Trench 6
Potato Creek

Trench 7
Potato Creek

Trench 8
Potato Creek

Trench 9 - Potato Creek

Upper Beaver Creek

Washing - Sluicing
at Trench 1